J Appendix J: TMDL Elements to Review Prior to Implementation Planning

Water Quality Target(s): TMDL loading limits are set to meet a specific water quality parameter threshold. The threshold used in the TMDL analysis is consistent with the threshold used in the 303(d) listing, which motivated the need for a TMDL analysis. When a numeric water quality criterion is the basis of a 303(d) listing, the water quality target used in the TMDL is likely to be the numeric criterion[28].

When a narrative criterion is the basis of a 303(d) listing, a systematic methodology must be used to quantify the water quality target. Derivation of water quality targets can often be complex if EPA has not provided specific standards or if site-specific conditions are critical to the determination. For example, water quality targets for high fish tissue concentrations of pollutants depend on risk calculations and site-specific rates of biological accumulation through the food chain.

Similarly, because EPA has not provided substance-specific sediment criteria, target values for bottom sediment concentrations of pollutants can be difficult to determine. This is further complicated when multiple pollutants are present.

Multiple water quality targets can also be associated with a single impairing substance. For example, the nutrient phosphorus can cause both excessive algae growth and depressed concentrations of dissolved oxygen. Water quality targets for both of these parameters must be achieved when setting the maximum loading threshold for phosphorus. In turn, implementation must ensure that both parameters are met.

It is also important to understand how the water quality target is measured. Is the measurement an "average" or "instantaneous"? If it is an average, is it an arithmetic or geometric mean? What is the averaging period (30-days, an average of the most recent five samples, annual, multi-year annual average)? Is it necessary to assess the dissolved parameter of interest, or the total parameter or both? Is it necessary to collect any supplemental information in addition to the parameter of interest, e.g., temperature or water hardness?

The water quality target is the threshold that is used in the TMDL analysis to define a violation. Clearly understanding how this threshold is defined will help ensure that implementation plans are properly focused. This is closely related to the next topic on the water quality impairment, which also addresses the issue of where and when the threshold is violated.

Water Quality Impairment: In addition to understanding the water quality target discussed above, impairments have other characteristics. For instance, the specific location of the impairment is important. Maryland's 303(d) listings for nutrients identify the Maryland 8-digit watershed, and indicate whether the impairment is in tidal water, non-tidal water, or both. It is also important to know precisely where within the given waterbody the standards are violated.

[28] This is not always the case. If elevated fish tissue concentrations of a toxic substance triggered the 303(d) listing, then the TMDL analysis must address the fish tissue concentration as the water quality target.

For example, a tidal waterbody can be rather large. Nutrient impairments are often isolated in a fairly confined area at the head of tide where the main non-tidal tributary meets the tidal river. This is the location where the nutrient-laden load is discharged to the warmer, slack tidal water and effectively comes to a stop. The most pronounced algae blooms tend to appear in these areas. If the impairment is geographically concentrated, then implementation should be targeted to affect a response in that location.

Temporal aspects of the impairment can be important too. In some cases, tidal nutrient impairments are most acute during the warm season when low stream flows lead to poorly flushed conditions and there is ample sunlight to grow algae. Some TMDL analyses set different limits for different seasons. It might be discovered that the effect of the point source load is the dominant issue in the summer season. This recognition, in the face of development growth pressure, could motivate a decision to redirect the location of the municipal treatment plant discharge. It could also motivate future planning to redirect part or all of the discharge from surface water to spray irrigation.

The frequency and magnitude by which the water quality threshold is exceeded can also provide insights regarding alternative courses of implementation. Given limited resources, some local jurisdictions might want to focus their resources on a waterbody that is not too severely impaired in order to meet a policy objective protecting relatively healthy water before turning attention to more severely impaired waters. Other jurisdictions might choose the reverse priority.

Another aspect of understanding the impairment is to know what key factors control the impairment. Part of that has to do with the source assessment, discussed below. But there are other things to consider. For example, a suspended sediment impairment in a tidal waterbody might primarily be due to the resuspension of bottom sediments. In this case, upstream sources of sediment might not be a significant cause. Thus, it might be better to focus implementation actions on the reestablishment of submerged aquatic vegetation, the baffling effect of which would help dampen the resuspension of bottom sediments.

In another case, poor flushing of a tidal system might be the primary factor causing persistent algal blooms. An assessment might reveal that a sediment bar created by a hurricane many years in the past, if dredged, could improve natural flushing and lead to dramatic water quality improvements.

In some cases, this kind of information will have been noted in the TMDL document or supporting materials. However, in other cases, such information will only come to light during the implementation process. It is not uncommon for citizens from the watershed to provide vital insights, which emphasizes the importance of involving the public in the TMDL implementation process.

In summary, understanding the characteristics of the impairment, particularly the specific location, is central to developing an efficient TMDL implementation plan.

Source Assessment: By definition, TMDLs must account for the sum of all sources, including natural sources. However, from a practical and legal standpoint, a TMDL analysis merely needs

to establish the receiving waterbody's capacity to assimilate those aggregate pollutants regardless of the details of the specific sources. Consequently, although TMDLs initiate the source assessment process, they do not necessarily provide a detailed accounting of sources; sources are constantly changing over time, and it is not the role of the TMDL developer to account for and track this progression. This function is part of the implementation planning and execution process.

Traditional source assessments involve an accounting of sources associated with land use cover, and visual surveys, including stream corridor assessments, designed to identify discrete atypical pollutant sources. Loads from these sources are estimated, with an accounting for reductions due to best management practices that are also part of the source assessment accounting. This process is discussed further in Section 5.1 "Tracking and Assessing Progress," and Appendix E, "Nonpoint Source Nutrient Loading Assessments Using Chesapeake Bay Program Land Use Loading Coefficients." Also See: Maryland DNR Stream Corridor Assessment Survey Protocols:
http://www.dnr.state.md.us/streams/pubs/SurveyProtocols2.pdf

The stressor identification process, a systematic process of identifying the causes of biological impairment in aquatic systems, is closely related to source assessment and stream corridor assessment, and is necessary to determine for which pollutant(s) the TMDL must be written. The process includes steps that often reveal pollutant sources. See: EPA Stressor Identification Process: http://www.epa.gov/ost/biocriteria/stressors/stressorid.pdf

The Maryland Department of Environment is also developing a stressor identification process. This will be closely integrated with Maryland's TMDL methodologies under development for biological impairments.

Another resource for pollutant source information is Maryland's Source Water Assessment Program. See: MDE Source Water Assessment Fact Sheet and Guidance:
http://www.mde.state.md.us/programs/waterprograms/water_supply/sourcewaterassessment/index.asp

See also the EPA Source Water Assessment web page:
http://www.epa.gov/safewater/protect/swpbibliography/source-water-assessment.html

The source assessment process can also make use of monitoring to help target implementation. For example, synoptic surveys of non-tidal streams, conducted as part of the Watershed Restoration Action Strategy (WRAS) development process, reveal the subwatersheds with high nitrate loadings. Similar comparison of data from the tributaries discharging to tidal rivers can help to reveal which tributaries are contributing the most pollutants.

Bacteria pose a special case. Septic systems are typically associated with nutrients and bacteria. Local health departments are delegated authority through subdivision regulations to ensure the proper location of septic systems relative to drinking water wells. They also regulate potential bacteria contamination of swimming beaches under delegated State authority and conduct source assessments to diagnose beach closure incidents. MDE assesses septic systems for potential

bacteria contamination of shellfish harvesting areas via sanitary shoreline surveys, the results of which can provide helpful source assessment information. MDE has also been conducting bacteria source tracking (BST) studies from 2003 to the present in support of developing TMDLs for bacteria. These BST studies will provide supporting information for bacteria TMDL implementation.

Natural sources are discussed in Section 5.1 "Tracking and Assessing Progress." Of particular interest is the topic of wildlife sources of bacteria.

A full understanding of pollutant sources should include an assessment of bottom sediments. Nutrient TMDLs account for these sources, both in terms of nutrient fluxes generated by the sediments, and dissolved oxygen consumed by the bottom sediments. Bottom sediments are also a common second-generation source of legacy toxic pollutants. That is, many toxic substances, which originate elsewhere, tend to accumulate in the bottom sediments. In addition to violating standards by directly impacting benthic organisms, the contaminated bottom sediments are a potential long-term source for exchange with the water column and biological accumulation in other aquatic life that do not live in the benthos.

A full accounting of pollutant sources should also consider atmospheric deposition. For waterbodies with large surface areas, relative to the watershed area, direct deposition of pollutants from the atmosphere can be significant. For mercury TMDLs, combustion leading to atmospheric deposition is the primary source. This subject is discussed further in Section 5.1 "Tracking and Assessing Progress."

In summary, a source assessment is an important aspect of TMDL implementation planning. If done in coordination with information on the specific location of the impairment, the source assessment can be geographically targeted to make more efficient use of limited resources.

TMDL Allocations: In addition to the maximum load itself, TMDL analyses must also identify an allocation of the total load to both point sources and nonpoint sources. Typically, a portion of the TMDL is also set aside as a margin of safety.

The TMDL and the allocations can be viewed as initial steps in an implementation plan. That is, the waterbody is impaired by too much pollution and the TMDL indicates how much is too much, thereby providing a quantified target for implementation. The allocations between point and nonpoint sources refine this quantified implementation target into broad source categories.

Allocations are not fixed permanently and may be reallocated; however, the reallocation of loads requires a public review process. This is because the public needs to have advance notice of proposed changes that might affect them.

The subject of managing allocations is addressed in more detail elsewhere in this document. Section 5.1.2.2 includes a discussion of regulated stormwater, which requires separate point source allocations. Section 5.8 on "Multi-Jurisdictional Coordination" considers the issue of allocations among different political jurisdictions. The following discussion of TMDL technical memoranda also expands on the subject of allocations.

Technical Memorandum: Nutrient TMDL documents submitted by MDE to EPA often include a Technical Memorandum. The Technical Memo is considered supporting information rather than a formal part of the TMDL analysis. The Technical Memo describes a viable partitioning of the loads among more detailed source categories. Although the Technical Memo does not identify formal allocations, it can be viewed as another initial implementation planning element of the TMDL development process.

For point source allocations, the Technical Memo typically identifies any source requiring an NPDES permit. Source categories for which there is insufficient information may be grouped together, as shown in the grouping of stormwater allocations below.

Stormwater allocations are a new TMDL requirement and have only been explicitly identified in a few of the approximately 100 TMDLs developed thus far. For these limited cases, separate stormwater allocations are identified for individual jurisdictions; however, allocations for industrial sources are grouped into the municipal allocations. For TMDLs developed prior to EPA's new requirement to identify stormwater allocations, the allocations are included implicitly as part of the nonpoint source allocation. See Section 5.1.2.2, under "Tracking and Assessing Progress," for further discussion.

Typical Point Sources Addressed in Technical Memoranda

- Municipal WWTPs
- Industrial Plants
- CAFOs
- **Grouping** {
  - MS4s
  - Construction Stormwater
  - Other Industrial Stormwater
- In general, anything requiring an NPDES Permit

For nonpoint sources, the Technical Memo does not provide as much useful information for TMDL implementation planning. Although the Technical Memo typically indicates a partitioning of the load to land use categories or subwatersheds, per EPA's request, this information should not be interpreted as allocations. That remains to be done as part of the TMDL implementation process, specifically through the issuance of permits.

Reasonable Assurance of Implementation: TMDL documents include a section entitled, "Assurance of Implementation," which provides basic TMDL implementation planning information. This required element of a TMDL is motivated by the need to ensure that the allocations between nonpoint source and point source categories are reasonably balanced. Although the determination of allocations is a State prerogative, the federal government provides some degree of oversight.

During the TMDL implementation planning process, local governments may revisit the balance between wasteload allocations and load allocations to seek more efficient, effective, or practical reductions to achieve the same goal. In addition, because sources are continually changing, load

allocation goals set at the time the TMDL was developed may no longer be accurate. A simple technique for conducting a preliminary analysis of this type is described in Appendix D.

Other Key Assumptions and Insights: TMDLs analyses address many technical details that affect whether or not water quality standards will be achieved. Awareness of technical assumptions and qualifying conditions can be vital to implementation planning and evaluation. For example, it is recognized that pH levels affect the release of phosphorus fluxes from bottom sediments. This understanding might motivate implementation actions that relate to pH, and steer monitoring plans to evaluate TMDL implementation.

As another example, nutrient and BOD TMDLs with significant point sources typically assume a minimum dissolved oxygen concentration in the treatment plant effluent, particularly during the dry season. Success in achieving standards depends on ensuring that aeration of the permitted discharge maintains a minimum level of oxygen. Similarly, effluent temperature, and water temperature in general, can have a very significant effect on the outcome of achieving dissolved oxygen goals. It is conceivable that the shading and temperature effect of strategically placed riparian forested buffers could be more significant in achieving dissolved oxygen goals than the buffer's role in reducing nutrient loads.

Model boundary conditions used in a TMDL analysis represent necessary conditions for achieving the TMDL goals and thus provide a potential diagnostic tool. For instance, consider the dissolved oxygen, chlorophyll, and nutrient concentrations used in a nutrient TMDL modeling scenario at the mouth of the tidal river and at the main non-tidal tributaries to the river (the model boundaries). These are the concentrations deemed to be necessary for achieving water quality standards in the tidal river. Monitoring data collected at these boundary points can be compared to the boundary concentrations used in the TMDL modeling scenario. This information can be used to target implementation and serves as an intermediate indication of TMDL implementation progress.